TECHNICAL REPORT
NATICK/TR-02/004

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EVALUATION OF THE IMPROVED FLAMELESS RATION HEATER

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December 2001

Final Report
August 2000 - August 2001

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REPORT DOCUMENTATION PAGE

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
21-12-2001	Final	August 2000 - August 2001

4. TITLE AND SUBTITLE
EVALUATION OF THE IMPROVED FLAMELESS RATION HEATER

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
643747

6. AUTHOR(S)
Wendy K. Johnson and F. Matthew Kramer

5d. PROJECT NUMBER
D610

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Soldier and Biological Chemical Command
U.S. Army Natick Soldier Center
Product Optimization and Evaluation Team
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Natick, MA 01760-5020

8. PERFORMING ORGANIZATION REPORT NUMBER
NATICK/TR-02/004

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
An evaluation was conducted at Fort Wainwright, AK to evaluate two prototype heaters and a modified version of the current Flameless Ration Heater (FRH). The evaluation consisted of distributing the Meal, Ready-to-Eat (MRE) (each of which contained one of the heaters in question) to infantry during regular field exercises. Surveys concerning the soldiers' use of the heaters, and how the heaters performed, were collected daily. The current FRH was used as a control. This evaluation shows that the modified version of the FRH is acceptable to soldiers in the field. The two prototype heaters are also generally acceptable, but would benefit from further development.

15. SUBJECT TERMS
FLAMELESS RATION HEATER
MRE(MEAL READY TO EAT)
SAFETY HAZARDS
SAFETY FACTORS
FIELD FEEDING
PROTOTYPE
FIELD EVALUATION
HEATERS
HOT MEALS
RATIONS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Wendy K. Johnson
U	U	U	SAR	87	19b. TELEPHONE NUMBER *(Include area code)* 508-233-4030

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Preface

This report details a field evaluation performed as part of the Flameless Ration Heater Improvement Program. The current Flameless Ration Heater (FRH) produces hydrogen when activated, resulting in safety issues due to the flammable nature of the gas, and to the fact that it could displace oxygen in an enclosed space (such as in a tent or a tank). The Navy is concerned about the possible release of hydrogen during transportation and storage of MREs on their ships. Prototype heaters were designed to work as well as the popular FRH, but without producing hydrogen. In addition, the current FRH packed in a foil bag is being considered as a short-term solution to prevent chemical reaction under high humidity conditions. In-house testing of the prototype heaters was also conducted, but is beyond the scope of this report.

The field evaluation was conducted at Fort Wainwright, AK with soldiers assigned to C Company, 2-1 Infantry of the 172nd Infantry Brigade. Two prototype heaters (the TDA water-activated heater in a foil over wrap, and the Tempra self-activating heater) and the FRH in a foil over wrap (FRH-O) were evaluated at this time. The FRH was also included, for comparative purposes.

Acknowledgments

This work was made possible through assistance from personnel at the Natick Soldier Center (NSC). Thanks to Max Biela, Operational Forces Interface Group (OFIG) representative, who acted as a liaison with the troops before and during the evaluation. Thanks also to Lauren Milch and Peter Sherman of the Combat Feeding Directorate, Larry L. Lesher of GEOCenters, and Shivaun Roach of the Product Optimization and Evaluation Team for their assistance with data collection.

Finally we express gratitude to the officers and soldiers of C Company, 2-1 Infantry of the 172nd Infantry Brigade for their support and cooperation through all phases of the evaluation, from initial planning through final completion of data collection.

EVALUATION OF THE IMPROVED FLAMELESS RATION HEATER

INTRODUCTION

The Flameless Ration Heater (FRH), which is currently packed in every Meal, Ready-to-Eat (MRE) menu, has proven to be an effective method for the individual soldier to obtain a hot meal in the field. However, the FRH produces hydrogen gas, which imposes transportation and storage restrictions because of the dangers associated with hydrogen, including flammability and the displacement of oxygen. The generation of hydrogen requires that the heater be used in a well-ventilated environment, limiting potential military and commercial applications. In addition to these safety issues, the Navy is concerned about the possible release of hydrogen during transportation and storage of MREs on their ships. In response to these concerns, prototype heaters, meant to work as well as the popular FRH but without producing hydrogen, are being developed under the Improved Flameless Ration Heater (IFRH) Program. In addition, the current FRH packed in a foil bag is being considered.

The current evaluation was the first to examine how the prototype IFRHs work in the field. Four heaters were brought to the field for evaluation. The current Flameless Ration Heater (FRH) was evaluated for comparative purposes. Three prototype heaters were also evaluated, including the FRH-O, which is the current FRH packaged in a foil overwrap. The TDA prototype is a water-activated heater much like the FRH in appearance and function, enclosed in a foil overwrap similar to the FRH-O. The Tempra is a self-contained heater which is activated by breaking the internal glycerine bubble and dispersing this solution through the heater.

OBJECTIVES

There are two main questions the current evaluation is meant to address:

1. Is the overwrap an acceptable short-term modification to the FRH?
2. In the long term, are any of the prototype heaters worth pursuing?

METHODS

An evaluation of the Improved Flameless Ration Heater (IFRH) was conducted in August 2000 at Fort Wainwright, AK with soldiers assigned to C Company, 2-1 Infantry of the 172nd Infantry Brigade during field training. Temperatures during the evaluation ranged from mild during the day to cold at night.

The test design was, of necessity, conceived while the prototypes were still undergoing laboratory evaluation. The assumption at that time was that there would be a total of three heater types to be evaluated, and the test design was developed in order to allow each soldier to use each heater type over the course of the evaluation. However, by the time of the actual evaluation there were four heater types to be evaluated, and the test design was modified accordingly. The soldiers were divided into groups based on platoon, with Headquarters company comprising the fourth group. According to the test design, each group would receive one of the heater types three days in a row, so that by the end of the 9-day evaluation each had the opportunity to try 3 of the 4 heaters.

The soldiers were pre-briefed before being deployed. At this time the purpose of the evaluation was explained to them, but they were not instructed in the use of the heaters. This was done in order to evaluate how well they understand the instructions enclosed with the heaters. They were told that the daily questionnaires were enclosed in the MRE meal bag along with a pencil, and that they should complete these questionnaires soon after eating their MRE meal. There were two different sets of mealcards: one for water activated heaters and another for the glycerine-activated heater. The mealcards were used to collect data about how each heater was used, how closely the instructions were followed, and asked the soldier's to evaluate that heater's performance.

After the pre-brief, the Background Questionnaire and the MREs for the first three days were distributed. The Background Questionnaire was used to collect demographic information as well as information about the soldier's field experience with

MREs and the current FRH. The MREs were distributed at this time because there was no guarantee that the data collectors could meet up with the soldiers during their first few days in the field. At the end of the evaluation a Final Questionnaire was distributed in order to allow the soldiers to make comparisons between the heaters they used during the evaluation.

RESULTS

BACKGROUND

The Background Questionnaire was completed by 93 soldiers. All of the participants were male. Ages ranged from 18 to 39, with a mean age of 24.53 years. Years in the military ranged from less than a year to 20 years with a mean of 4.73 years. All had used the current FRH before.

Table 1. Demographics

Rank	**N**	
E1 - E4	44	
E4 - E6	43	
E7 - E9	4	
O1 - O3	2	
Ethnic Group	%	
White	69.9	
Black	10.8	
Hispanic	10.8	
Asian/Pacific Islander	4.3	
American Indian/Alaskan Native	1.1	
Other*	3.2	*Other: Portugese, Irish American, Middle Eastern.
Region	%	
North Central	22.6	
Mid Atlantic	21.5	
South Atlantic	20.4	
Pacific	11.8	
New England	8.6	
South Central	6.5	
Mountain	4.3	
Other*	4.3	*Other: Puerto Rico; Peru; South America - Equador; Wales, UK.

Flameless Ration Heater: The soldiers rated on a 9-point scale (1 = "Dislike Extremely" and 9 = "Like Extremely") how much they like or dislike both the current heater and a hypothetical heater which works like the FRH, but does not require water. The mean rating for the current heater is 6.37 (between "like slightly" and "like moderately"); sixty percent like the FRH at least "slightly." The mean rating for a heater which does not require water is 7.48 (between "like moderately" and "like very much"); eighty percent like this concept at least "slightly." A paired t-test shows that these means are significantly different ($p < 0.001$).

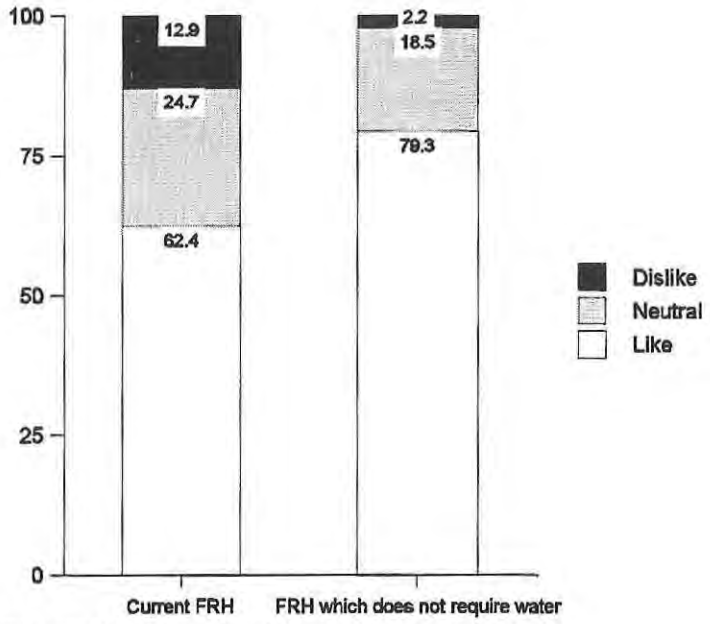


Figure 1. Percent Like/dislike the FRH.

Field Experience: All of the soldiers report that they have MREs at least once per day while in the field. Two-thirds (66.6%) report that they have MREs twice per day, 22.6% report that they have MREs three times per day, and 10.8% have them once per day.

When they do heat an MRE entree in the field, the majority (75.3%) use the FRH. Of the rest, 8.6% report using a stove (including one who uses a stove in the winter and the FRH in the summer), 7.5% do not heat their MRE entree, and 3.2% report that they do not eat the MRE entree. As seen in Figure 2, the soldiers are split between those who use more than half of the FRHs they receive (49.5%), and those who use less than half of their FRHs (42.0%). (Other responses include: use the FRH to heat fewer than 1 in 3 entrees, use occasionally, use when the entree is frozen, and use when there is the time.)

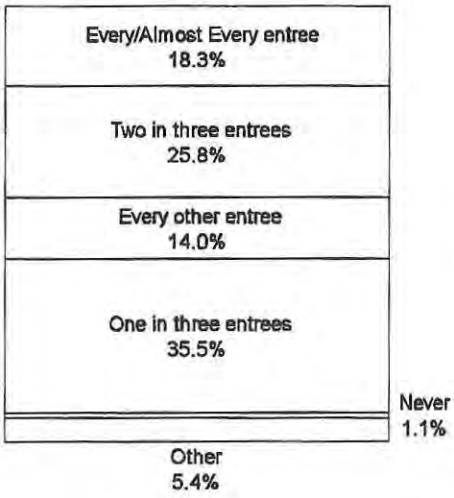


Figure 2. How often do you use the FRH

Eighty-three percent feel that it is "very" important to have an MRE heater which takes no more than 15 minutes to heat an entree (Table 2). Only nine percent felt that this feature was "not at all" important. Less than ten percent (7.6%) know when they are going to eat more than fifteen minutes ahead of time, and most (81.7%) do not know at what time they will eat. Sixty-one percent (61.3%) "never" know at least an hour ahead of time.

Table 2. Importance of a 15-minute heating time.

	N	Percent
Not at all	8	8.6
Slightly	1	1.1
Moderately	7	7.5
Very	77	82.8

Most of these soldiers (82.8%) report that they have never been **burned** by the FRH. Of those who had (n = 16), six were burned by the steam, and this usually occurred when they removed the entree from the heater. Most of the soldiers report that they receive **a heater which does not work** "Seldom/Never" (39.8%) or "Half of the time" (40.9%). No one said that they "Always" have a heater that does not work. Fifty-eight percent (58.1%) throw away **unused FRHs**. Others save the heater (17), give or trade away the heater (8), use it as a hand or body warmer (5), or always use the heater (4) ["other" = 10].

The soldiers chose from a list of possible responses what reasons they had for not using the FRH in the field (write-in and multiple responses were possible). The reasons most often given for not using the FRH in the field are that there is not enough time to heat the MRE entree, and that they are too busy to heat the entree (Table 3). No one reported that they do not use the FRH when they are close to an open flame.

Table 3. Reasons for not using the FRH.

(Multiple responses possible.)

Reasons	Percent	
Not enough time to heat MRE entree	73.1	
Too busy	49.5	
Would not waste water for heating	32.3	
Weather/Climate conditions	22.6	
FRH does not heat well	22.6	
Not eating the MRE entree	20.4	
Not tactical	18.3	
Produces an odor	17.2	
Eating in an enclosed area	12.9	
Always use FRH	11.8	
Other*	9.7	*Other: cannot use the FRH to make hot beverages; easier to eat without heating; the FRH does not work in the cold.
Prefer to eat the entree cold	8.6	
Creates a mess	7.5	
Using the heater restricts mobility	3.2	
Too complicated	1.1	
Too close to an open flame	0.0	

MEALCARDS

Mealcards were collected every day of the evaluation, resulting in a total of 716 mealcards for 89 soldiers. There are at least 160 cards for each heater type (Table 4).

Table 4. Number of mealcards by heater type.

	Total	
Type	**Mealcards**	**Soldiers**
FRH	168	58
FRH-O	166	62
TDA	161	58
Tempra	221	78

Most of the mealcards (93.0%) show that the heater was used to heat the Entree and 9.4% of the time it was used to heat a starch, (6.9% "other" items, and 4.2% heater not used). Other heated items (n = 48) include: cheese (12), nothing (3), peanut butter (2), self (2), Toaster pastry and cheese, Toaster pastry, M&Ms and Peanut butter, and a camouflage stick (24 cards were missing this information). [These percents do not add up to 100% because the heaters were sometimes used to heat more than one item.]

Thirteen percent (13.1%) of the cards report that more than one item was heated. When one item only was heated (n = 623), it was usually the entree (92.0%). When more than one item was heated (n = 91), one of the items was always the entree, and the other item(s) were most often a starch (55) or a spread (15).

When they did not use their MRE heater (n = 26), their stated reasons include: Did not eat (6), Too busy (4), too busy & did not eat (4), time, did not want to heat any MRE items (3), used a Yukon stove (2), existing hole in bag (1, TDA), no ventilation (1, FRH), and the heater was already activated (1, Tempra) (missing data = 4).

Instructions: Whenever they used one of the evaluation heaters the soldiers were asked if they had understood and followed the instructions (Appendices E, F G). Virtually all of the mealcards report that the instructions are understood, and most of the soldiers reported that they followed the instructions. Those who reported that they did not follow the instructions were asked to explain what they did differently (Table 5).

Table 5. Were the heater instructions understood and followed

	Percent		
	Understood	**Followed**	**Which steps were not followed**
FRH	100.0	95.6	Overfilled with water (2), not heated in box, element not held above fill lines (missing = 2)
FRH-O	100.0	95.5	Did not read (3), element not held above fill lines, overfilled by accident (missing = 2)
TDA	96.8	94.8	Not heated in box, element not centered on entree (missing = 6)
TEMPRA	100.0	95.8	The heater was not shaken to activate (5), heated in pocket rather than in the box, too dark to read the instructions

In order to check this finding, many of the questions on the mealcards focus on how, exactly, the soldier used the heater. Other questions asked the soldiers to describe how the heater worked (Appendices B, C). These data are described below.

Three of the heaters (FRH-O, TDA, and FRH) are **water activated**. Fill lines are printed at the bottom of the heater bag and the soldiers are instructed to fill the bag to a point between these lines. In order to get an accurate measure, the heating element and the MRE entree should be held above the fill lines while pouring.

Sixty-five percent of the mealcards for the FRH-O and three-quarters of the mealcards for the TDA and the FRH show that the water was added to a point between the fill lines (Table 6). When the incorrect amount of water was added, it was usually to a point above the fill lines (too much water). When adding the water the heating element was held above the fill lines at least seventy percent of the time. The food pouch was usually in the bag at this time and, when it was, the pouch was usually held above the fill lines as the water was added.

Table 6. Percentage who followed instructions when adding water.

		FRH	FRH-O	TDA
	N:	158	156	156
Amount of Water Added:	Above Fill Lines	24.7	28.8	14.7
	Between Fill Lines	**73.4**	**64.7**	**79.5**
	Below Fill Lines	1.9	6.4	5.8
Element Held Above Fill Lines		73.4	72.4	83.3
Food Pouch in Heater Bag		84.2	80.8	85.3
↘Food pouch held above fill lines*		74.2	82.3	87.7

*Of those times the food pouch was in the bag.

The Tempra is not activated by adding water, but is a self-contained heater which is activated by breaking the enclosed **glycerine bubble** and shaking the heater to disperse the solution. The tan heater turns black during this process so, given enough light, the soldiers can easily see how well the glycerine is being dispersed. The majority (97.2%) broke the bubble, as instructed, using the heels of their hands (others used their fingers, their fist (3) or their forehead). Most (84.9%) dispersed the solution by shaking the heater, as instructed, while a minority accomplished this by wringing, kneading or rubbing the heater with their fingers, hands, or an entree box (22), or by rolling and unrolling the heater (4). Ninety percent of the time (91.7%) the soldiers were able to fully disperse the solution throughout the heater.

For the water activated heaters, the entree is supposed to be inserted into the bag alongside the activated heating element. With the Tempra, the heater is supposed to be wrapped around the entree. For all of the heaters, the entree and the heater should be inserted into the entree box while heating. The FRH and FRH-O should be placed at an angle while heating, and the TDA should be placed flat. There are no such instructions for the Tempra. The instructions for all heater types tell the soldier to knead the entree pouch after heating in order to ensure that the entree is uniformly warm. For some entrees, however, such as the Grilled Chicken Breast or the Beef Franks, this step has little meaning because the entree is a solid piece of food.

The pouch and activated heater were usually inserted into the entree box during the heating time for all four heaters, although this is done slightly less often with the TDA (Table 7). For the water activated heaters, the pouch was almost always alongside the element during heating. The Tempra was wrapped around the entree during heating ninety-eight percent of the time. The FRH and FRH-O were usually in the correct position (at an angle) while heating, and the TDA was in the proper position (flat) forty percent of the time. The entree was frequently kneaded after heating.

Table 7. Percentage of the time these instructions were followed.

	FRH	FRH-O	TDA	TEMPRA
Pouch & Heater in Entree Box	96.2	93.6	89.1	95.4
Pouch alongside Element	97.5	92.9	96.8	--
Wrap element around Pouch	--	--	--	98.2
Heater in Correct Position	78.5	86.5	42.9	--
Entree Kneaded after Heating	80.8	74.2	81.9	80.1

Heating time: According to the instructions, the entree should be heated for 10 to 15 minutes when using either the FRH, FRH-O or TDA; the recommended heating time for the Tempra is 15 minutes. A Oneway ANOVA shows that the mean length of time the entree is in the heater is significantly different ($p < 0.05$) by heater type. Specifically, the mean heating times for the FRH and the Tempra are longer than the mean heating times for the FRH-O and the TDA (Table 8).

Table 8. Minutes entree was heated.

	X	SD	N	Significantly longer than:	Min	Max
FRH	10.06	4.10	157	FRH-O, TDA	2	30
TEMPRA	9.96	4.67	212	FRH-O, TDA	3	30
FRH-O	8.55	4.24	157	None	2	20
TDA	7.78	3.38	156	None	2	15

According to the instructions, the heating time for the FRH, FRH-O and TDA is 10 to 15 minutes. Two-thirds of the time the FRH was used (66.2%), 47.8% of the time the FRH-O was used, and 42.3% of the time the TDA was used, the entree was heated for at least ten minutes (Figure 3).

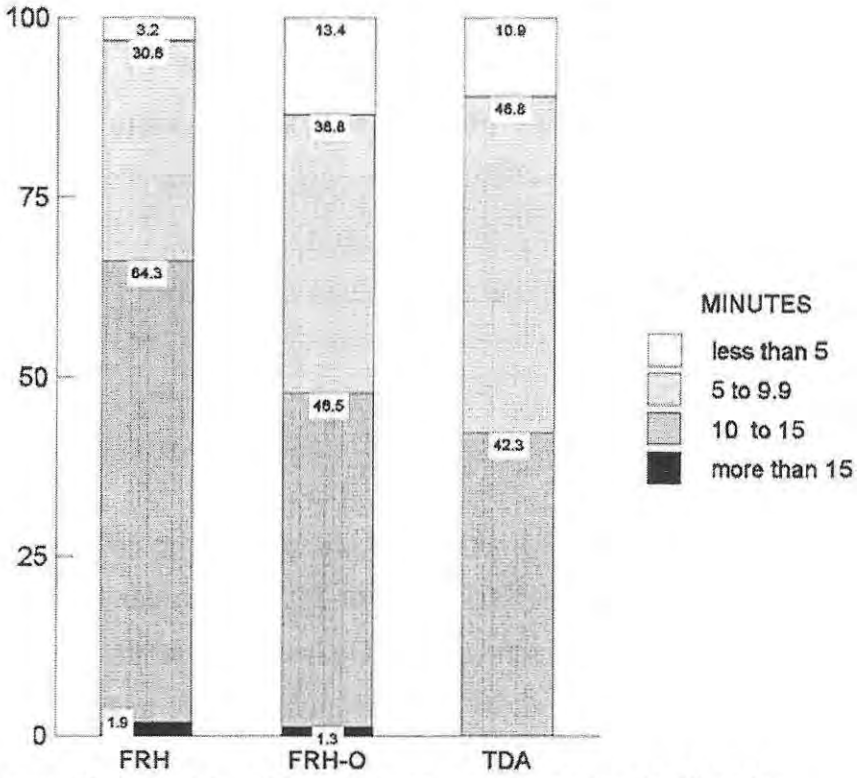


Figure 3. Length of time entree was in activated heater.

The recommended heating time for the Tempra is 15 minutes; 21.7% of the time the entree was heated for fifteen minutes, and 5.7% of the time it was heated longer than that. Thirty percent of the time (29.7%) it was heated for 5 to 10 minutes, and nine percent of the time (8.5%) it was heated for less than five minutes.

Events: For over half of the cards for each heater type, the heater was never **too hot to handle** (Table 9). There were two reports that the TDA burned or melted the bag, and one that it leaked. There was one instance of the Tempra becoming too hot to handle while the soldier was still dispersing the solution, and one report that it "blew out of the box." One soldier told his data collector that the TDA "caught on fire."

Table 9. Percent of the time the heater was too hot to handle.

	Never	Inserting into box	Removing from Box	Other	When:
FRH-O	75.5	9.7	15.5	0.6	the whole time
TDA	70.5	2.6	23.1	3.8	burned or melted the bag (2), while in the box, while leaking, when [he] took the meal from the bag (missing = 1)
FRH	67.5	12.1	24.8	2.5	when it was thrown away (2), while in the box (missing = 1)
TEMPRA	64.6	9.4	23.6	6.1	while in the box (3), put away, blew out box, when put starch in the box, after I ate, while putting in box, while shaking, it took about half minute to activate (missing = 3)

At least sixty percent of the cards for the FRH-O, TDA, and FRH and three percent of the cards for the Tempra state that the heater gave off an **odor** (Table 10). Twenty percent or less of the cards for the FRH-O and the TDA, and ten percent of those for the FRH, say that this odor was a problem.

Table 10. Odor produced by heater.

	Percent	
	Gave off an odor	Odor was a problem*
FRH	68.4	10.2
FRH-O	63.3	20.0
TDA	60.3	17.2
TEMPRA	3.2	0.0

*Percent of those who detected an odor.

Most of the cards for the FRH (89.2%) and the FRH-O (81.6%) and half of the cards for the TDA (53.2%) say that the heaters gave off **steam.** Six percent of the cards for the Tempra (6.0%) say that this heater gave off steam. This finding is consistent with how these heaters are expected to perform.

Over ten percent of the cards for the FRH and FRH-O and about six percent of the cards for the TDA state that water **leaked** from the heater bag (Table 11). Half of the cards for the FRH-O and sixty percent of the cards for the FRH state that the heater **absorbed** all of the water poured into it. Eighty percent of the cards for the TDA say that all of the water was absorbed.

Table 11. Water leaking from heater and/or absorbed by heater.

	Percent	
	Leaked	**Absorbed**
FRH	12.4	63.9
FRH-O	11.5	53.8
TDA	5.8	79.4

There was some reported **damage** to all of the heaters during use. For the TDA heater, 14.1% of the mealcards reported damage, and virtually all of these described the heater burning or melting the bag (Table 12). Sometimes this resulted in a hole in the bag; one soldier reported that the heating element "pellets" fell out.

Table 12. The heater damaged the bag.

	Percent	How the bag was damaged
TDA	14.1	burned/melted (17) resulting in a hole (9), decal peeled off (missing = 3)
TEMPRA	6.0	(missing = 13)
FRH	2.5	bag ripped when they inserted the entree (2), existing hole, (missing = 1)
FRH-O	2.5	plastic ripped, poked hole in bag

Six percent of the cards for the Tempra say that there was damage, but the damage is never described. However, 43.8% of the Tempra mealcards (including 10 of the 13 which reported damage) show that the heater "**puffed up**" when it was activated. (Heat may build up inside of the Tempra if it has no where to go, causing this heater to "puff up.") The seams of this heater have sometimes been observed to separate when the heater puffs up; this may what the soldiers mean by damage, but at this point there is no way of knowing for sure.

Five percent or less of the mealcards received for each heater type report that the soldier **burned** himself while using the heater. For the TDA, there was only one report of heater-inflicted burns (Table 13).

Table 13. Burned by heater.

	%	Description:
FRH	5.1	heated up quickly (2), fingertip, steam burned hand and leg, when flipping entree to heat the other side, by steam when adding entree to bag, taking out of the box, when throwing heater away, too hot to handle
TEMPRA	4.6	waited too long before putting in box (2), burned tongue, handling bag, trying to heat starch, distributing solution, (missing = 4)
FRH-O	3.8	Removing meal from heater (2), entree burned hand, too hot to handle, when putting in box (heated quickly), (missing = 1)
TDA	0.6	while adding water (the heater activated quickly)

Satisfaction with the temperature of the entree was rated on a 7-point scale where 1 = "Very Dissatisfied" and 7 = "Very Satisfied." For the sake of consistency, only those who heated the entree and the entree alone are included in this analysis (Table 14). The means for each of the heaters fall between "slightly satisfied" and "moderately satisfied" on the scale. A Oneway ANOVA shows that these means are not significantly different ($p > 0.05$). Most of the cards for the FRH (88.7%), the FRH-O (76.3%), the TDA (81.3%), and the Tempra (81.3%) state that the entree was **heated through**.

Table 14. Satisfaction with temperature (7-point scale).

	X	SD	N	If Dissatisfied, why
FRH	5.96	1.13	141	entree not heated enough (4), not heated uniformly, and "did not activate until 15 minutes after the entree was added to the heater"
Tempra	5.81	1.68	165	entree not getting hot enough (12), the time it takes to use (5), did not work (3), entree not heated uniformly (2), the heater did not activate uniformly, could not distribute the solution, too noisy, and too hot (missing data = 1).
TDA	5.66	1.55	141	did not heat the entree (3), did not work at all (3), took too long (3), not heated uniformly (2), and odor (missing data = 4)
FRH-O	5.57	1.27	122	not heated uniformly (3), not getting the entree hot enough (3), leaking, time, and the element fell out when removing the entree from the bag (missing data = 2)

Overall **ease of use** was rated on a 5-point scale for each heater, where 1 = "Extremely Difficult" and 5 = "Extremely Easy." According to a Oneway ANOVA, the mean ratings for the FRH, the FRH-O, and the TDA are significantly higher (easier to use) than the mean for the Tempra ($p < 0.05$). All of these means, however, fall between "slightly easy" and "extremely easy" on the 5-point scale (Table 15).

Table 15. Ease of use (5-point scale).

	X	SD	N	If at all difficult, why
TDA	4.73	0.51	156	noisy, not wide enough, it's just like the original one (missing data= 3)
FRH-O	4.69	0.59	158	the heater bag is too small for the entree (2), the (element) folded in the bag, the heater fell out when removing the meal (missing data= 4)
FRH	4.49	0.82	160	fitting the food pouches in the heater bag (2), adding water (2), overwrap was noisy and not tactical, would not work (missing data= 7)
Tempra*	4.27	0.94	218	distributing the solution (11, including: too much shaking = 4), too much time (7, including: to activate = 4, to heat = 1), used 2 heaters before it got hot, putting it in the entree box, effort, not warm enough, couldn't get to heat, trying to keep dry by using only one hand in the rain, (missing data = 18)

*The Tempra is significantly different from the other three ($p < 0.05$).

There were two additional ease of use ratings for the Tempra, regarding the glycerine bubble and dispersing the solution through the heater. The mean ease of breaking the Tempra's glycerine bubble is 4.46 (between "slightly" and "extremely" easy on the 5-point scale). The mean ease of dispersing the solution is 3.55 (between "neither easy nor difficult" and "slightly easy").

Overall like/dislike of the heater was rated on a 9-point scale where 1 = "Dislike Extremely" and 9 = "Like Extremely." The mean ratings for the Tempra and the FRH fall near "like moderately" on the scale. The TDA and the FRH-O mean ratings fall between "like slightly" and "like moderately." A Oneway ANOVA shows that these mean ratings are significantly different ($p < 0.05$). The mean ratings for the Tempra and the FRH are significantly higher (liked more) than that for the FRH-O (Table 16). The mean rating for the TDA is not significantly different from any of the other mean ratings.

Table 16. Overall like/dislike (9-point scale).

	X	SD	N	Significantly higher than: ($p < 0.05$)
FRH	7.13	1.54	158	FRH-O
TEMPRA	7.01	2.14	216	FRH-O
TDA	6.69	2.02	155	None
FRH-O	6.45	1.74	157	None

FINAL QUESTIONNAIRE

The Final Questionnaires were distributed at the end of the evaluation. Eighty-four of the soldiers completed this questionnaire. Seventy-three of these are for soldiers who tried all three of the heater types assigned to them. The following analyses require that the soldier make comparisons between the three heaters assigned to their group, so only those who tried all three are included below.

Recommendations: At the end of the evaluation, the soldiers were asked to recommend one of the three heaters they had evaluated. They were also asked which of these heaters they most and least preferred. Only those who tried a heater over the course of the evaluation could recommend that heater. The n's in Table 17 reflect this.

Half of those who had tried the Tempra recommend that the Army purchase this heater for the MREs (Table 17). Thirty percent recommend the FRH, a quarter recommend the TDA, and almost fifteen percent recommend the FRH-O. This is consistent with the most and least preferred responses.

Table 17. Recommendations and Preferences.

		Percent		
	N Tried	Recommend for MRE	Most Prefer	Least Prefer
Tempra	68	55.9	58.8	23.5
FRH	47	29.8	34.0	40.4
TDA	52	26.9	21.2	36.5
FRH-O	52	13.5	11.5	36.5

However, Table 17 hides differences between the evaluation groups. As shown in Table 18, each platoon (and Headquarters Company, n = 5) was assigned to receive different heaters over the course of the evaluation. All three platoons evaluated the Tempra. First (n = 21) and Second (n = 26) Platoons recommend the Tempra over the other heaters they evaluated. Third Platoon (n = 21) recommends and prefers the FRH. No one in First Platoon recommends the FRH, and less than five percent of this Platoon prefer it the most. (Second Platoon was not issued the FRH.)

Table 18. Recommendations and preferences by Platoon.

Percent Recommend a heater

	Platoon		
	1st	2nd	3rd
Tempra	85.7	65.4	14.3
FRH	0.0	--	61.9
TDA	--	19.2	23.8
FRH-0	14.3	15.4	--

Percent Most Prefer a heater

	Platoon		
	1st	2nd	3rd
Tempra	76.2	80.8	14.3
FRH	4.8	--	66.7
TDA	--	11.5	19.0
FRH-0	19.0	7.7	--

Percent Least Prefer a heater

	Platoon		
	1st	2nd	3rd
Tempra	4.8	7.7	61.9
FRH	61.9	--	9.5
TDA	--	46.2	28.6
FRH-0	33.3	46.2	--

Projected use of each of the heaters they had evaluated was estimated, assuming that the heater was the only one available. Only those who used the heater in question are included in Figure 4. Ninety percent (90.4%) would use the FRH at least half of the time, and eighty percent (82.7%) would use the Tempra at least half of the time. Three quarters (75.4%) would use the TDA and 67.8% would use the FRH-O at least half of the time.

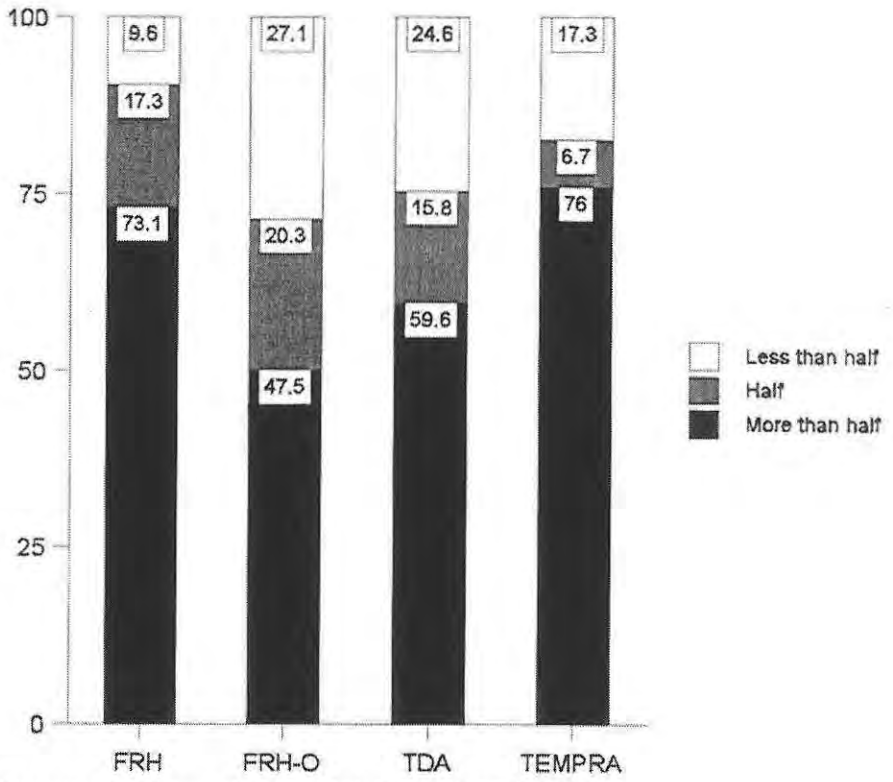


Figure 4. How often would use the heater.

This data, however, shows the same pattern of differences between the three platoons as was shown above with the recommended and preferred data (Table 19). Third platoon would use the FRH more often than First platoon would. Third platoon would use the Tempra less often than First or Second would, although sixty percent would use it more than half of the time.

Table 19. Would use the heater more than half of the time.

	Percent of Platoon		
	1st	2nd	3rd
Tempra	85.7	76.9	61.9
FRH	57.1	--	90.5
TDA	--	53.8	61.9
FRH-0	66.7	42.3	--

Tactical: Each heater was deemed to be tactical by more than half of the soldiers who had tried it. Those who said that it was not tactical were asked to explain why. For the water activated heaters, odor was the most frequently mentioned reason, followed by steam (especially with the FRH and FRH-O). The shaking and noise associated with distributing the Tempra's activating solution was often mentioned as a tactical concern (Table 20).

Table 20. Is this heater tactical

	Total N	% Yes	Tactical concerns:
TDA	56	83.9	odor (6), steam, noise, and time
FRH	52	78.8	odor (6), steam (3), noise (3), it uses water (2); it takes time to use, and "interferes with mobility"
FRH-O	59	74.6	odor (8), steam (6), noise (2), time, and "interferes with mobility"
Tempra	75	68.0	shaking (10), noise (9), the time it takes to heat (5), the effort to use (2), and "weather dependent"

Overwrap: The FRH-O and the TDA heaters were over wrapped, which adds a step when using the heater and results in more trash. Most of these soldiers (72.8%) say that the additional trash is not a problem. Those who find it to be at least a slight problem say that it would be more to carry (6) and dispose of (4), and more weight (3).

Two-thirds (66.7%) say that having an overwrap on the heater will not make them more or less likely to use the heater. Seven (8.6%) said that it would make them less likely to use the heater because there would be too much trash (5), or because it would take too long.

Activator bubble: Those who used the Tempra during the evaluation rated how much they liked or disliked activating heaters with an activator bubble. The mean rating for this feature is 7.40 (n = 75), which falls between "like moderately" and "like very much" on the 9-point scale. Most (91.3%) like it at least "slightly."

Safety Issues: Because the current MRE heater produces hydrogen gas, the printed instructions say that the heater should not be used in an enclosed area or near an open flame. Most (78.0%) think it is at least slightly important that they be able to use the MRE heater in an enclosed area (Figure 5). Over half (57.3%) think that it is at least slightly important that they be able to use the MRE heater near an open flame.

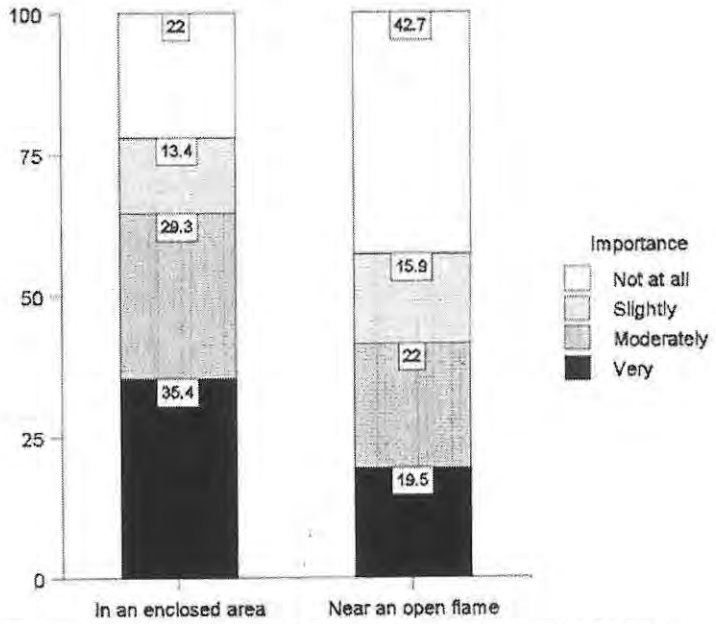


Figure 5. How important it is that the heater can be used under these conditions.

Like/dislike Concept characteristics: In addition to the heaters included in the current evaluation, other prototypes have been offered for consideration. The following data attempts to evaluate the possible characteristics of these heaters.

The Concept characteristics were rated on a 9-point acceptability scale where 1 = "Dislike Extremely" and 9 = "Like Extremely." The soldiers liked the concept of a heater which would keep an entree warm for 30 minutes (x = 7.36), and they liked the concept of an air-activated heater (x = 7.18). The mean rating for heating their entree in a pocket was neutral (x = 4.71), which reflects a split in the data between positive (38.1%) and negative (40.5%) ratings (Figure 6). The 60 minute heating time was not well received (x = 2.07). Overall, the concept has a neutral rating (x = 4.88), with the soldiers split between positive (46.4%) and negative (41.7%) ratings.

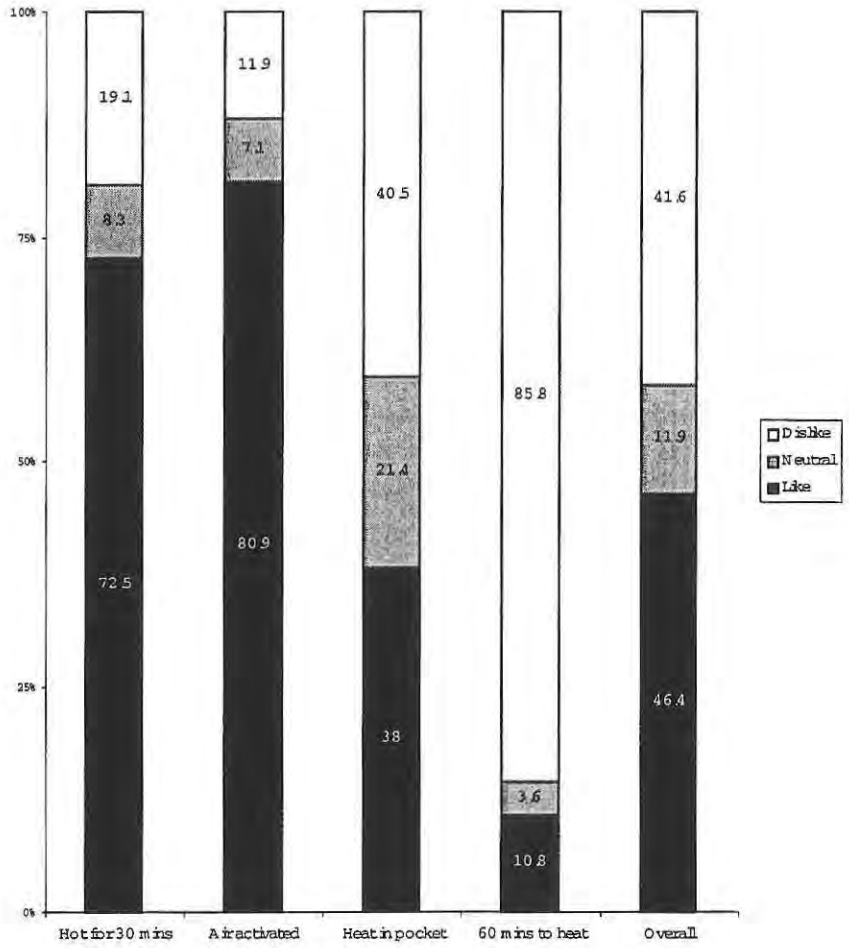


Figure 6. Like/dislike Concept characteristics.

Plan 60 minutes ahead. Sixty-three percent (63.1%) would "never" be able to plan 60 minutes ahead to heat their entree. A quarter (26.2%) anticipate that they would be able to do this for one out of three entrees, and 10.7% would be able to plan ahead for at least every other entree.

Mobility. The mean rating for the Concept heater is 3.61, or between "decrease slightly" and "neither increase nor decrease" mobility (7-point scale). Thirty-eight percent (38.1%) said that this heater would "neither increase nor decrease" their mobility in the field. Thirty-seven percent (36.9%) said that this heater would *decrease* their mobility at least "slightly" and 25.0% said that it would *increase* their mobility at least slightly.

Projected use of FRH and Concept. Given the choice between using the current FRH and the Concept, two-thirds (66.6%) would "usually" or "always" use the FRH. A quarter (26.2%) would "use each half of the time," and 7.1% would use the Concept "usually" or "always."

SUMMARY

Field experience. All of the soldiers report that they have MREs at least once a day while in the field, and that they typically use the FRH when they heat their entree. Fifty-eight percent throw away unused FRHs, while others save the heater, give or trade it away, or use it as a body warmer. The mean rating for the current heater on the 9-point acceptability scale falls between "like slightly" and "like moderately" and the mean rating for a hypothetical heater which does not require water falls between "like moderately" and "like very much."

Because the current MRE heater produces hydrogen gas, the printed instructions say that the heater should not be used in an enclosed area or near an open flame. Most think it is important that they be able to use the MRE heater in an enclosed area and over half think that it is important that they be able to use the MRE heater near an open flame.

Current Evaluation. Four heaters were evaluated at this time, including the current FRH and three prototype heaters. The prototype heaters were the FRH-O (the current FRH packaged in a foil overwrap), the TDA (a water-activated heater similar to the FRH-O), and the Tempra (a self-contained heater which does not require water to activate). During the evaluation, these heaters were typically used to heat the entree, and they were also used to heat other items, or as body warmers. When the soldiers did not use the heater they said that it was because they either did not eat, they were too busy, they did not have enough time, or they did not want to heat anything.

Virtually all of the soldiers think that the instructions are easily understandable, and most reported that they followed them. However, specific questions were asked about how the heater was used and these data show some deviations from the instructions.

The instructions for all of the **water-activated heaters** are to add water to a point between the fill lines. This was usually done for the FRH-O (65%), the TDA

(75%), and the FRH (75%). When the incorrect amount of water was added, it was usually to a point above the fill lines (too much water). When adding the water, the heating element and the food pouch were usually held above the fill lines, as instructed. Over ten percent of the FRH and the FRH-O and six percent of the TDA mealcards say that water leaked from the heater. Sixty percent of the FRH and half of the FRH-O mealcards and eighty percent of the mealcards for the TDA state that all of the water was absorbed.

The recommended heating time for all of the water-activated heaters is 10 to 15 minutes. The mealcards show that the heating time was reported as at least 10 minutes for half of the FRH-Os, forty percent of the TDA, and two-thirds of the FRH. The majority of the cards show that the **Tempra** was activated as instructed (by breaking the bubble and dispersing the solution by shaking). A quarter of the time the entree was heated for 15 minutes (as instructed) or longer with the Tempra.

When using the FRH or the FRH-O, about five percent of the mealcards report that the soldier burned himself. Five percent of the Tempra mealcards report that the soldier burned himself, and there was one instance of the Tempra becoming too hot to handle while the soldier was still dispersing the solution. There was one report of a soldier burning himself while using the TDA. Sixty percent of the cards for the FRH, the FRH-O, and the TDA say that these heaters gave off an odor. No more than twenty percent say that this odor was a problem. Three percent of the cards state that the Tempra gave off an odor. Most of the mealcards say that the FRH, the FRH-O and the TDA gave off steam, and six percent say that the Tempra gave off steam.

Fourteen percent of the mealcards report damage to the TDA heater bag, and virtually all of these state that the heater burned or melted the bag. Sometimes the melting resulted in a small hole in the bag and, in one case, the pellets in the heating element fell out. Thirteen of the Tempra mealcards say that there was damage to the heater, but the damage is never described. However, forty percent of the Tempra mealcards (including 10 of the 13 which reported damage) show that the heater expanded ("puffed up") when it was activated. The seams of this heater have

sometimes been observed to separate when the heater expands and this may be what the soldiers mean by damage.

Ratings. Tempra has a significantly lower **ease of use** rating than the other three heaters, but all of these means fall between "slightly easy" and "extremely easy" on the 5-point scale.

The mean **satisfaction with temperature** for each of the heater types falls between "slightly satisfied" and "moderately satisfied" on the scale (not significantly different), and most of the mealcards state that the entree was heated through. The Overall **acceptability** mean ratings for the Tempra and the FRH fall near "like moderately" on the scale and are significantly higher (liked more) than the FRH-O. The TDA and the FRH-O mean ratings also fall on the positive end of the scale (between "like slightly" and "like moderately").

There were two additional ease of use ratings for the Tempra. one for the glycerine bubble and another for dispersing the solution through this heater. The mean ease of breaking the Tempra's **glycerine bubble** falls between "slightly" and "extremely" easy and the mean ease of **dispersing the solution** falls between "neither easy nor difficult" and "slightly easy." At the end of the evaluation, those who used the Tempra rated how much they liked or disliked having a heater with an activator bubble; the mean rating for this feature falls between "like moderately" and "like very much."

Each heater was deemed to be **tactical** by more than half of the soldiers who had tried it. For the FRH and FRH-O, odor was the most frequently mentioned as a characteristic which would be a tactical concern, followed by steam. For the Tempra, the shaking and noise associated with distributing the activating solution was reported as a tactical concern.

The FRH-O and the TDA heaters were each overwrapped in a package similar in appearance to the other MRE items. Most say that having an **overwrap** on the heater would not affect how often they would use the heater. Generally speaking, the additional trash is not a problem for the individual soldier.

Comparisons. Half of those who used the Tempra recommend that the Army purchase this heater for the MREs. Thirty percent of those who used the FRH over the course of the evaluation recommend this heater. A quarter of those who used the TDA, and fifteen percent of those who used the FRH-O, recommend these heaters.

Each platoon was assigned to receive different heaters over the course of the evaluation (all three platoons evaluated the Tempra). First and Second Platoons recommend the Tempra over the other heaters they evaluated. Third Platoon, however, recommends and prefers the FRH which is interesting because no one in First Platoon, which also evaluated the FRH, recommends this heater. The soldiers in each platoon had ample opportunity to discuss the heaters among themselves, which could explain why these recommendations would be consistent within the same platoon. For example, all three groups appear to have had the same experience with the Tempra, but it may be that they chose to weigh the pros (does not require water, heats the entree well) and cons (activating the heater is relatively difficult and a tactical concern) of this heater differently.

The soldiers estimated their **projected use** of each of the heaters, assuming that the heater in question was the only one available. According to this data, the FRH, the Tempra, and the TDA would be used the most often. The FRH-O would be used less frequently, but over half of the soldiers estimate that they would use it at least half of the time.

Concept. In addition to the heaters included in the current evaluation, other prototypes have been offered for consideration. When asked to consider potential characteristics of these future heaters, the soldiers expressed a liking for a heater which would keep an entree warm for 30 minutes, and they also liked the concept of an air-activated heater. The mean rating for heating their entree in a pocket was neutral, which reflects a split in the data between positive and negative ratings. The 60 minute heating time was not well received. Most do not know when they are going to eat their MRE until just before they do, few have this information fifteen minutes ahead of time,

and even fewer know when they are going to eat any further ahead of time than fifteen minutes. Sixty-three percent say that they would "never" be able to plan 60 minutes ahead to heat their entree. Most think that it is "very" important to have an MRE heater which takes no more than 15 minutes to heat an entree.

The mean rating for the Concept heater (a heater with all of the abovementioned characteristics) suggests that this heater would either "decrease slightly" or "neither increase nor decrease" their **mobility** in the field. Overall, the concept has a neutral **acceptability** rating, with the soldiers split between positive and negative ratings. Given the choice between using the current FRH and the Concept, two-thirds would "usually" or "always" use the FRH.

CONCLUSIONS

According to the data collected during the current evaluation, the overwrap is an acceptable modification to the FRH. The FRH-O does seem to be performing less well than the FRH, but it is still performing reasonably well. Later laboratory tests of similar heaters show that the fill lines on these heaters are not always printed in the correct place. For these heaters, following the instructions could result in adding an insufficient amount of water, which would effect heater performance. Despite this potential problem, satisfaction with temperature and overall liking are similar between the FRH and the FRH-O. Most of the soldiers say that having an overwrap on the heater would not affect how often they would use the heater and that the additional trash is not a problem.

Half of those who had tried the Tempra recommend that the Army purchase this heater for the MREs. Thirty percent recommend the FRH, a quarter recommend the TDA, and almost fifteen percent recommend the FRH-O. The ratings for satisfaction with the temperature and overall liking of these two heaters are as good as those for the FRH. Based on this user data, there seems to be reason to pursue either or both of these prototypes as replacements for the FRH.

Overall, both of the prototype heaters (the TDA and the Tempra) are acceptable to many of the soldiers, but have their own particular limitations. These limitations (as well as more general concerns) are outlined below.

The recommended **heating time** for all of the water-activated heaters is 10 to 15 minutes, and is 15 minutes for the Tempra. The soldiers often used a shorter heating time during the evaluation. Further questioning reveals that because of the short amount of time they often have to eat their MRE they do not always have enough time to heat and eat an entree. Shorter heating times would be beneficial in these

situations.

Both the TDA and the Tempra were occasionally **damaged** over the course of the evaluation. According to the mealcards, the TDA occasionally melts the heater bag during normal use, which may result in holes in the bag, and difficulty in removing the entree from the heater. The Tempra sometimes expands after activation, which may result in the seams of the heater separating (this is not a safety issue).

The soldiers found it easy to break the Tempra's glycerine bubble, but dispersing the activating solution was not as easy and the shaking and noise associated with distributing the activating solution was a tactical concern. The soldiers liked having a heater with an activator bubble, but the method of dispersing the solution needs to be addressed before it is acceptable for use in a field situation.

The water activated heaters often gave off an **odor** and sometimes gave off **steam**. Both of these events can be a tactical concern. The TDA has fewer reported incidents of steam, probably because there is no hydrogen produced by this heater to carry the steam away. Reducing the odor and the steam these heaters produce would make them more tactical.

Ratings for satisfaction with the temperature and overall liking of the TDA and the Tempra are as good as those for the FRH. Mean ratings for satisfaction with the temperature and overall liking are also the same between these two prototypes. Based on user data, there is reason to pursue either or both of these prototypes.

This document reports research undertaken at the U.S. Army Soldier and Biological Chemical Command, Soldier Systems Center, and has been assigned No. NATICK/TR-02/004 in a series of reports approved for publication.

APPENDICES

Appendices: Table of Contents

Appendix A
Background Questionnaire

BACKGROUND QUESTIONNAIRE

ID: _____

Thank you for participating in this evaluation. Please answer the following questions for our records. All of the information you provide will be kept confidential. This information is necessary in order to provide a combat ration that will meet everyone's needs. Please respond to each question by filling in the circle that corresponds with your answer.

1. Rank:

O	①	②	③	④	⑤	⑥			
WO	①	②	③	④	⑤				
E	①	②	③	④	⑤	⑥	⑦	⑧	⑨

2. Age:

—	—	years
①	①	
②	②	
③	③	
④	④	
⑤	⑤	
⑥	⑥	
⑦	⑦	
⑧	⑧	
⑨	⑨	
⓪	⓪	

3. How many **years** have you been in the Armed Services?

—	—	years	◯ Less than 1 year.
①	①		
②	②		
③	③		
④	④		
⑤	⑤		
⑥	⑥		
⑦	⑦		
⑧	⑧		
⑨	⑨		
⓪	⓪		

4. Gender: Ⓜ MALE Ⓕ FEMALE

5. What race/ethnic group do you belong to? (Please mark all that apply.)

① American Indian/Alaskan Native
② Asian/Pacific Islander
③ Black
④ Hispanic
⑤ White
⑥ Other (Please specify):

6. What part of the country did you live in the longest before the age of 16?

① New England (ME, NH, VT, MA, CT, RI)
② Middle Atlantic (NJ, NY, PA, DE, MD)
③ South Atlantic (DC, VA, WV, NC, SC, GA, FL)
④ North Central (OH, IN, IL, MI, WI, MN, IA, MO, ND, SD, NE,
⑤ South Central (KY, TN, AL, MS, AR, LA, OK, TX)
⑥ Mountain (ID, WY, CO, MT, AZ, NM, UT, NV)
⑦ Pacific (WA, OR, CA, AK, HI)
⑧ Other (Please specify): _____

THE FOLLOWING QUESTIONS APPLY TO FIELD TRAINING AND DEPLOYMENTS.

7. When in the field, how often do you typically eat MREs?

NEVER	ONCE PER DAY	TWICE PER DAY	THREE TIMES PER DAY
⓪	①	②	③

8. Typically, how far ahead of time do you know at what time of day you will be eating your MRE?

Just before I eat	15 minutes	30 mins	45 mins	60 mins	more than 60 minutes	OTHER:
○	○	○	○	○	○	○ _____

9. How often do you know at least an hour ahead of time when you will eat your MRE?

NEVER	ONE OUT OF THREE MREs	EVERY OTHER MREs	TWO OUT OF THREE MREs	EVERY MREs	OTHER:
⓪	①	②	③	④	⑤ _____

10. How often do you use the MRE heater?

NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER:
⓪	①	②	③	④	⑤ _____

11. How do you usually heat up your MRE entree in the field?

① MRE heater ② Do Not Heat

③ Heat Tabs ④ OTHER (Please specify): _____

12. When you have an MRE but do not use the heater, what do you usually do with the UNUSED heater?

① Save ② Throw away

③ Always use the MRE heater ④ Give or trade away

⑤ OTHER (please specify): _____

13. How important is it to you to have an MRE heater which takes no more than 15 minutes to heat an entree?

NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT
⓪	①	②	③

14. Have you ever used the MRE heater before? Ⓨ YES Ⓝ NO →If NO, then go to **QUESTION 18.**

15. How much do you like/dislike the MRE heater?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
①	②	③	④	⑤	⑥	⑦	⑧	⑨

16. How often do you find that your MRE heater does not work?

NEVER	SELDOM	HALF OF THE TIME	OFTEN	ALWAYS
⓪	①	②	③	④

17. Have you ever been burned while using an MRE heater? Ⓨ YES Ⓝ NO

↘If YES, please explain what happened: _____

18. How much would you like/dislike an MRE heater similar to the current heater, but which was activated without adding water to it?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
①	②	③	④	⑤	⑥	⑦	⑧	⑨

19. For what reasons do you NOT use the MRE heater in the field? (Please mark all that apply.)

- ◯ Always use the MRE heater
- ◯ MRE heater does not heat well
- ◯ Would not waste water for heating
- ◯ Creates a mess
- ◯ Too complicated
- ◯ Not enough time to heat MRE entree
- ◯ Not eating the MRE entree
- ◯ Prefer to eat the entree cold
- ◯ Using heater restricts my mobility
- ◯ Produces an odor
- ◯ Too busy
- ◯ Weather/Climate conditions
- ◯ Not tactical
- ◯ Too close to an open flame
- ◯ Eating in an enclosed area (tent, vehicle, etc)
- ◯ Other (Please explain):

_____

THANK-YOU.

Appendix B
Mealcards for Water-activated Heaters
(FRH, FRH-O, TDA)

DAILY QUESTIONNAIRE Ⓐ Ⓑ Ⓒ Ⓓ

NAME: _____ ID: _____ Date: _____

1. What did you heat with the enclosed MRE heater? (Please mark all that apply.)

   ① Did not use MRE heater ② Heated the entree (Chili Mac, etc)

   ③ Heated the starch (Rice, etc) ④ Other (Please specify): _____

   ↘If you DID NOT use the MRE heater, what was the most important reason why?

   ① Did not want to HEAT my entree ② Too busy

   ③ Did not EAT my entree ④ Other (Please explain): _____

2. How satisfied were you with the temperature of your entree?

VERY DISSATISFIED	MODERATELY DISSATISFIED	SLIGHTLY DISSATISFIED	NEITHER SATISFIED NOR DISSATISFIED	SLIGHTLY SATISFIED	MODERATELY SATISFIED	VERY SATISFIED
①	②	③	④	⑤	⑥	⑦

   ↘If at all DISSATISFIED (1-4), please explain why: _____

IF YOU USED THE ENCLOSED HEATER, PLEASE ANSWER THE FOLLOWING QUESTIONS:

3. Did you FOLLOW the MRE heater instructions printed on the bag step by step?.... Ⓨ Ⓝ

   If NO, which step(s) did you NOT follow? _____

4. Were the instructions easily understandable?..... Ⓨ Ⓝ

   If NO, what part was unclear? _____

5. When you added water to activate the heater, to what point did you fill the bag?

   ① Below the fill lines ② Between the fill lines ③ Above the fill lines

6. When you added the water, did you hold the HEATING ELEMENT above the fill lines? Ⓨ Ⓝ

7. Was the FOOD POUCH in the bag when you added the water?..... Ⓨ Ⓝ

   ↘If YES, did you hold it above the fill lines? ..... Ⓨ Ⓝ

8. Did you put the activated heater and food pouch into the entree box?..... Ⓨ Ⓝ

9. While heating, was the food pouch alongside the heating element?..... Ⓨ Ⓝ

10. While heating, was the heater at an angle, or was it laid flat?

    ① At an angle ② Flat ③ Other (Please explain) _____

11. Once activated, how long did you leave the food pouch in the MRE heater? _____ minutes

12. Did you knead your entree before eating it?..... Ⓨ Ⓝ

13. Did you find that the heater was ever too hot to handle?

    ① No ② Yes, before I put it in the entree box

    ③ Yes, when I removed it from the entree box ④ Yes, other: _____

14. Please mark the bubbles in the "Yes" and "No" columns to show whether or not the following things happened when you used this MRE heater.

A. Did the heater give off an odor?..... (Y) (N)

↘If YES, was this odor a problem?..... (Y) (N)

B. Did the heater give off steam?..... (Y) (N)

C. Did water leak from the plastic bag?..... (Y) (N)

D. Did the heating element absorb all of the water poured into the bag?..... (Y) (N)

↘If NO, how much water was left? _____.

E. Did activating the heater damage the heater bag in any way?..... (Y) (N)

↘If YES, please describe the damage _____.

F. Was the entree heated all of the way through?..... (Y) (N)

G. OTHER (Please specify) _____.

15. How easy or difficult was it for you to use this heater?

EXTREMELY DIFFICULT	SOMEWHAT DIFFICULT	NEITHER EASY NOR DIFFICULT	SOMEWHAT EASY	EXTREMELY EASY
(1)	(2)	(3)	(4)	(5)

↘If at all DIFFICULT (1-3), please explain why: _____

16. Overall, how much do you like the MRE heater you used today?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

17. When you used the heater today, were you burned by it?..... (Y) (N)

↘If YES, please explain: _____

18. Comments about the heater you used today:

THANK-YOU

(A) (B) (C) (D)

Appendix C
Mealcard for the Tempra Heater
(not water-activated)

DAILY QUESTIONNAIRE Ⓐ Ⓑ Ⓒ Ⓓ

NAME: _____ ID: _____ Date: _____

1. What did you heat with the enclosed MRE heater? (Please mark all that apply.)

   ① Did not use MRE heater ② Heated the entree (Chili Mac, etc)

   ③ Heated the starch (Rice, etc) ④ Other (Please specify): _____

   ↘If you DID NOT use the MRE heater, what was the most important reason why?

   ① Did not want to HEAT my entree ② Too busy ③ Other (Please explain):_____

   ④ Did not EAT my entree ⑤ Bubble had already popped and heater had turned black

2. How satisfied were you with the temperature of your entree?

VERY DISSATISFIED	MODERATELY DISSATISFIED	SLIGHTLY DISSATISFIED	NEITHER SATISFIED NOR DISSATISFIED	SLIGHTLY SATISFIED	MODERATELY SATISFIED	VERY SATISFIED
①	②	③	④	⑤	⑥	⑦

   ↘If at all DISSATISFIED (1-4), please explain why: _____

IF YOU USED THE ENCLOSED HEATER, PLEASE ANSWER THE FOLLOWING QUESTIONS:

3. Did you FOLLOW the MRE heater instructions printed on the bag step by step?.... Ⓨ Ⓝ

   If NO, which step(s) did you NOT follow? _____

4. Were the instructions easily understandable?..... Ⓨ Ⓝ

   If NO, what part was unclear? _____

5. Did you use the heels of your hands to break the activator bubble?..... Ⓨ Ⓝ

   ↘If NO, how did you break it? _____.

6. How easy or difficult was it to break the bubble?

EXTREMELY DIFFICULT	SOMEWHAT DIFFICULT	NEITHER EASY NOR DIFFICULT	SOMEWHAT EASY	EXTREMELY EASY
①	②	③	④	⑤

7. After breaking the bubble, did you shake the heater?..... Ⓨ Ⓝ

   ↘If NO, what did you do? _____

8. Were you able to fully change the heater color to black?..... Ⓨ Ⓝ

9. How easy or difficult was it change the heater color from tan to black?

EXTREMELY DIFFICULT	SOMEWHAT DIFFICULT	NEITHER EASY NOR DIFFICULT	SOMEWHAT EASY	EXTREMELY EASY
①	②	③	④	⑤

10. Did you wrap the heater around the entree?..... (Y) (N)

11. Did you put the heater and entree into the entree carton?..... (Y) (N)

12. Once activated, how long did you leave the food pouch in the MRE heater? _____ minutes

13. Did you knead your entree before eating it?..... (Y) (N)

14. Did you find that the heater was ever too hot to handle?

(1) No (2) Yes, before I put it in the entree box

(3) Yes, when I removed it from the entree box (4) Yes, other: _____

15. Please mark the bubbles in the "Yes" and "No" columns to show whether or not the following things happened when you used the MRE heater.

A. Did the heater give off an odor?..... (Y) (N)

↘If YES, was this odor a problem?..... (Y) (N)

B. Did the heater give off steam?..... (Y) (N)

C. Did the heater "puff up" when it was activated?..... (Y) (N)

D. Did activating the heater damage the heater bag in any way?..... (Y) (N)

↘If YES, please describe the damage _____.

E. Was the entree heated all of the way through?..... (Y) (N)

F. OTHER (Please specify) _____.

16. Overall, how easy or difficult was it for you to use this heater?

EXTREMELY DIFFICULT	SOMEWHAT DIFFICULT	NEITHER EASY NOR DIFFICULT	SOMEWHAT EASY	EXTREMELY EASY
(1)	(2)	(3)	(4)	(5)

↘If at all DIFFICULT (1-3), please explain why: _____

17. Overall, how much do you like the MRE heater you used today?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

18. When you used the heater today, were you burned by it?..... (Y) (N)

↘If YES, please explain: _____

19. Comments about the heater you used today:

THANK-YOU (A) (B) (C) (D)

Appendix D

Final Questionnaires

FINAL QUESTIONNAIRE

① ② ③ ④

NAME: _____ ID: _____

Thank you for participating in our evaluation. Your opinions are very important in determining what changes will be made in the rations. Your answers will be kept confidential. Please answer honestly and thoughtfully by filling in the circle corresponding with your answer. Thank-you.

During this field exercise you had the opportunity to use three different versions of MRE heater. The following questions are about these heaters, which are referred to by questionnaire/label color.

1. Which of these heaters did you use during the past field exercise?

Did you use this heater?		LABEL		DESCRIPTION
Ⓨ	Ⓝ	YELLOW	TT-FRH	Water activated heater
Ⓨ	Ⓝ	GREEN	TT-FL	Water activated heater packed in a tan pouch
Ⓨ	Ⓝ	ORANGE	TEMPRA	Heater activated by breaking activator bubble

2. If you could recommend that the Army purchase **one** of the heaters you used during this study to be included in every MRE, which would you pick?

Please choose one:

YELLOW GREEN ORANGE

Ⓨ Ⓖ Ⓞ

↘Why do you prefer this heater? _____

3. Of the heaters you used, which do you like the **most**? (Please mark only one heater.)

YELLOW GREEN ORANGE

Ⓨ Ⓖ Ⓞ

4. Of the heaters you used, which do you like the **least**? (Please mark only one heater.)

YELLOW GREEN ORANGE

Ⓨ Ⓖ Ⓞ

5. How often would you use each type of heater <u>if it were the only one available</u> in the MREs?

HEATER	NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER: (Please specify)
YELLOW	⓪	①	②	③	④	⑤ _____
GREEN	⓪	①	②	③	④	⑤ _____
ORANGE	⓪	①	②	③	④	⑤ _____

6. Can these heaters be used in tactical situations?

HEATER	YES	NO	→ If NO, why not?
YELLOW	Ⓨ	Ⓝ	_____
GREEN	Ⓨ	Ⓝ	_____
ORANGE	Ⓨ	Ⓝ	_____

7. Some of the MRE heaters you received during this study were packaged in a tan pouch (these heaters had Green labels and questionnaires).

A. Is the additional trash a problem?

NO PROBLEM	SLIGHT PROBLEM	MODERATE PROBLEM	LARGE PROBLEM
⓪	①	②	③

→ If it is a problem (1-3), please explain why: _____

B. Would this additional packaging make you more or less likely to use the heater?

MUCH LESS LIKELY	SOMEWHAT LESS LIKELY	NEITHER MORE NOR LESS LIKELY	SOMEWHAT MORE LIKELY	MUCH MORE LIKELY
①	②	③	④	⑤

→ If you are LESS LIKELY (1-3) to use, please explain why: _____

① Too much trash

② Too many steps

③ Other _____

① ② ③ ④

8. Some of the heaters you used during this field training exercise were activated without adding water (These heaters had Orange labels and questionnaires).

How much did you like/dislike activating these heaters by popping the activator bubble?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
①	②	③	④	⑤	⑥	⑦	⑧	⑨

↘If you DISLIKE this at all (1-4), please explain why: _____

9. How important is it to you that you are able to use the MRE heater in an enclosed area (tent, vehicle, etc) or near an open flame?

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT
Enclosed area	⓪	①	②	③
Near open flame	⓪	①	②	③

10. Do you have any other comments about any of the heaters you used during this field training exercise?

① YES ⓪ NO

_____

_____

_____

① ② ③ ④

THE FOLLOWING QUESTIONS REFER TO THE HEATER CONCEPT DESCRIBED BELOW.

Picture an MRE heater which:

- is air activated
- requires heating an MRE entree in a BDU, LBE, or rucksack pocket
- takes 60 minutes to heat the entree
- keeps the entree hot for 30 minutes beyond the heating time

11. Using the following scale, please rate how much do you like/dislike these characteristics about the Concept.

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
1	2	3	4	5	6	7	8	9

The heater is air activated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Requires heating the entree in a pocket	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Takes 60 minutes to heat an entree	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Keeps the entree hot 30 mins beyond heating time	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Overall, how much do you like/dislike this Concept?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

12. Would using this sort of heater increase or decrease your mobility in the field?

DECREASE VERY MUCH	DECREASE MODERATELY	DECREASE SLIGHTLY	NEITHER INCREASE NOR DECREASE	INCREASE SLIGHTLY	INCREASE MODERATELY	INCREASE VERY MUCH
(1)	(2)	(3)	(4)	(5)	(6)	(7)

→ How would it increase/decrease your mobility? _____

13. How often would you be **able to plan 60 minutes ahead** in order to have a hot entree?

NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER: (Please specify)
(0)	(1)	(2)	(3)	(4)	(5) _____

14. If you had a choice, how often would you use either the Concept or the MRE heater?

ALWAYS USE CONCEPT	USUALLY USE CONCEPT	USE EACH HALF OF THE TIME	USUALLY USE MRE heater	ALWAYS USE MRE heater
○	○	○	○	○

→Why would you choose one over the other? _____

15. Do you have comments about the Concept heater described above? (Y) (N)
(If you need more space, please continue on the other side.)

THANK-YOU.

(1) (2) (3) (4)

FINAL QUESTIONNAIRE

① ② ③ ④

NAME: _____ ID: _____

Thank you for participating in our evaluation. Your opinions are very important in determining what changes will be made in the rations. Your answers will be kept confidential. Please answer honestly and thoughtfully by filling in the circle corresponding with your answer. Thank-you.

During this field exercise you had the opportunity to use three different versions of MRE heater. The following questions are about these heaters, which are referred to by questionnaire/label color.

1. Which of these heaters did you use during the past field exercise?

Did you use this heater?		LABEL		DESCRIPTION
Ⓨ	Ⓝ	GREEN	TT-FL	Water activated heater packed in a tan pouch
Ⓨ	Ⓝ	WHITE	TDA	Water activated heater packed in a tan pouch
Ⓨ	Ⓝ	ORANGE	TEMPRA	Heater activated by breaking activator bubble

2. If you could recommend that the Army purchase **one** of the heaters you used during this study to be included in every MRE, which would you pick?

Please choose one:

GREEN WHITE ORANGE

Ⓖ Ⓦ Ⓞ

↘Why do you prefer this heater? _____

3. Of the heaters you used, which do you like the **most**? (Please mark only one heater.)

GREEN WHITE ORANGE

Ⓖ Ⓦ Ⓞ

4. Of the heaters you used, which do you like the **least**? (Please mark only one heater.)

GREEN WHITE ORANGE

Ⓖ Ⓦ Ⓞ

5. How often would you use each type of heater <u>if it were the only one available</u> in the MREs?

HEATER	NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER: (Please specify)
GREEN	⓪	①	②	③	④	⑤ _____
WHITE	⓪	①	②	③	④	⑤ _____
ORANGE	⓪	①	②	③	④	⑤ _____

6. Can these heaters be used in tactical situations?

HEATER	YES	NO	→ If NO, why not?
GREEN	Ⓨ	Ⓝ	_____
WHITE	Ⓨ	Ⓝ	_____
ORANGE	Ⓨ	Ⓝ	_____

7. Some of the MRE heaters you received during this study were packaged in a tan pouch (these heaters had Green or White labels and questionnaires).

A. Is the additional trash a problem?

NO PROBLEM	SLIGHT PROBLEM	MODERATE PROBLEM	LARGE PROBLEM
⓪	①	②	③

→ If it is a problem (1-3), please explain why: _____

B. Would this additional packaging make you more or less likely to use the heater?

MUCH LESS LIKELY	SOMEWHAT LESS LIKELY	NEITHER MORE NOR LESS LIKELY	SOMEWHAT MORE LIKELY	MUCH MORE LIKELY
①	②	③	④	⑤

→ If you are LESS LIKELY (1-3) to use, please explain why: _____

① Too much trash

② Too many steps

③ Other _____

① ② ③ ④

8. Some of the heaters you used during this field training exercise were activated without adding water (These heaters had Orange labels and questionnaires).

How much did you like/dislike activating these heaters by popping the activator bubble?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

↘If you DISLIKE this at all (1-4), please explain why: _____

9. How important is it to you that you are able to use the MRE heater in an enclosed area (tent, vehicle, etc) or near an open flame?

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT
Enclosed area	(0)	(1)	(2)	(3)
Near open flame	(0)	(1)	(2)	(3)

10. Do you have any other comments about any of the heaters you used during this field training exercise?

(1) YES (0) NO

_____

_____

_____

(1) (2) (3) (4)

THE FOLLOWING QUESTIONS REFER TO THE HEATER CONCEPT DESCRIBED BELOW.

Picture an MRE heater which:

is air activated

requires heating an MRE entree in a BDU, LBE, or rucksack pocket

takes 60 minutes to heat the entree

keeps the entree hot for 30 minutes beyond the heating time

11. Using the following scale, please rate how much do you like/dislike these characteristics about the Concept.

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
1	2	3	4	5	6	7	8	9

The heater is air activated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Requires heating the entree in a pocket	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Takes 60 minutes to heat an entree	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Keeps the entree hot 30 mins beyond heating time	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Overall, how much do you like/dislike this Concept?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

12. Would using this sort of heater increase or decrease your mobility in the field?

DECREASE VERY MUCH	DECREASE MODERATELY	DECREASE SLIGHTLY	NEITHER INCREASE NOR DECREASE	INCREASE SLIGHTLY	INCREASE MODERATELY	INCREASE VERY MUCH
(1)	(2)	(3)	(4)	(5)	(6)	(7)

➜ How would it increase/decrease your mobility? _____

13. How often would you be **able to plan 60 minutes ahead** in order to have a hot entree?

NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER: (Please specify)
(0)	(1)	(2)	(3)	(4)	(5) _____

14. If you had a choice, how often would you use either the Concept or the MRE heater?

ALWAYS USE CONCEPT	USUALLY USE CONCEPT	USE EACH HALF OF THE TIME	USUALLY USE MRE heater	ALWAYS USE MRE heater
○	○	○	○	○

➜Why would you choose one over the other? _____

15. Do you have comments about the Concept heater described above? (Y) (N)
(If you need more space, please continue on the other side.)

THANK-YOU.

(1) (2) (3) (4)

FINAL QUESTIONNAIRE

① ② ③ ④

NAME: _____ ID: _____

Thank you for participating in our evaluation. Your opinions are very important in determining what changes will be made in the rations. Your answers will be kept confidential. Please answer honestly and thoughtfully by filling in the circle corresponding with your answer. Thank-you.

During this field exercise you had the opportunity to use three different versions of MRE heater. The following questions are about these heaters, which are referred to by questionnaire/label color.

1. Which of these heaters did you use during the past field exercise?

Did you use this heater?		LABEL		DESCRIPTION
Ⓨ	Ⓝ	YELLOW	TT-FRH	Water activated heater
Ⓨ	Ⓝ	WHITE	TDA	Water activated heater packed in a tan pouch
Ⓨ	Ⓝ	ORANGE	TEMPRA	Heater activated by breaking activator bubble

2. If you could recommend that the Army purchase **one** of the heaters you used during this study to be included in every MRE, which would you pick?

Please choose one:

YELLOW WHITE ORANGE

Ⓨ Ⓦ Ⓞ

↘Why do you prefer this heater? _____

3. Of the heaters you used, which do you like the **most**? (Please mark only one heater.)

YELLOW WHITE ORANGE

Ⓨ Ⓦ Ⓞ

4. Of the heaters you used, which do you like the **least**? (Please mark only one heater.)

YELLOW WHITE ORANGE

Ⓨ Ⓦ Ⓞ

5. How often would you use each type of heater <u>if it were the only one available</u> in the MREs?

HEATER	NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER: (Please specify)
YELLOW	⓪	①	②	③	④	⑤ _____
WHITE	⓪	①	②	③	④	⑤ _____
ORANGE	⓪	①	②	③	④	⑤ _____

6. Can these heaters be used in tactical situations?

HEATER	YES	NO	→ If NO, why not?
YELLOW	Ⓨ	Ⓝ	_____
WHITE	Ⓨ	Ⓝ	_____
ORANGE	Ⓨ	Ⓝ	_____

7. Some of the MRE heaters you received during this study were packaged in a tan pouch (these heaters had White labels and questionnaires).

A. Is the additional trash a problem?

NO PROBLEM	SLIGHT PROBLEM	MODERATE PROBLEM	LARGE PROBLEM
⓪	①	②	③

→ If it is a problem (1-3), please explain why: _____

B. Would this additional packaging make you more or less likely to use the heater?

MUCH LESS LIKELY	SOMEWHAT LESS LIKELY	NEITHER MORE NOR LESS LIKELY	SOMEWHAT MORE LIKELY	MUCH MORE LIKELY
①	②	③	④	⑤

→ If you are LESS LIKELY (1-3) to use, please explain why: _____

① Too much trash

② Too many steps

③ Other _____

① ② ③ ④

8. Some of the heaters you used during this field training exercise were activated without adding water (These heaters had Orange labels and questionnaires).

How much did you like/dislike activating these heaters by popping the activator bubble?

DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
①	②	③	④	⑤	⑥	⑦	⑧	⑨

↘If you DISLIKE this at all (1-4), please explain why: _____

9. How important is it to you that you are able to use the MRE heater in an enclosed area (tent, vehicle, etc) or near an open flame?

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT
Enclosed area	⓪	①	②	③
Near open flame	⓪	①	②	③

10. Do you have any other comments about any of the heaters you used during this field training exercise?

① YES ⓪ NO

_____

_____

_____

① ② ③ ④

THE FOLLOWING QUESTIONS REFER TO THE HEATER CONCEPT DESCRIBED BELOW.

Picture an MRE heater which:

- is air activated
- requires heating an MRE entree in a BDU, LBE, or rucksack pocket
- takes 60 minutes to heat the entree
- keeps the entree hot for 30 minutes beyond the heating time

11. Using the following scale, please rate how much do you like/dislike these characteristics about the Concept.

	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
	1	2	3	4	5	6	7	8	9
The heater is air activated	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Requires heating the entree in a pocket	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Takes 60 minutes to heat an entree	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Keeps the entree hot 30 mins beyond heating time	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Overall, how much do you like/dislike this Concept?	①	②	③	④	⑤	⑥	⑦	⑧	⑨

12. Would using this sort of heater increase or decrease your mobility in the field?

DECREASE VERY MUCH	DECREASE MODERATELY	DECREASE SLIGHTLY	NEITHER INCREASE NOR DECREASE	INCREASE SLIGHTLY	INCREASE MODERATELY	INCREASE VERY MUCH
①	②	③	④	⑤	⑥	⑦

➔ How would it increase/decrease your mobility? _____

13. How often would you be **able to plan 60 minutes ahead** in order to have a hot entree?

NEVER	ONE OUT OF THREE ENTREES	EVERY OTHER ENTREE	TWO OUT OF THREE ENTREES	EVERY ENTREE	OTHER: (Please specify)
⓪	①	②	③	④	⑤ _____

14. If you had a choice, how often would you use either the Concept or the MRE heater?

ALWAYS USE CONCEPT	USUALLY USE CONCEPT	USE EACH HALF OF THE TIME	USUALLY USE MRE heater	ALWAYS USE MRE heater
○	○	○	○	○

➔Why would you choose one over the other? _____

15. Do you have comments about the Concept heater described above? Ⓨ Ⓝ
(If you need more space, please continue on the other side.)

THANK-YOU.

① ② ③ ④

Appendix E
Instructions for the FRH and FRH-O

MRE (MEAL, READY-TO-EAT) HEATER

US 06421

8970-01-321-9153

TEAR HERE TO USE BAG

WARNING

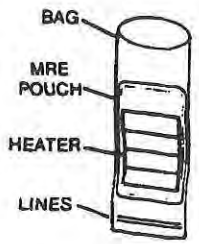
1. Vapors released by activated heater contain hydrogen, a flammable gas. Do not place an open flame in the vapor.
2. Vapors released by activated heater can displace oxygen. When ten or more heaters are used inside a vehicle or shelter, ensure the ventilation system is operating or a top hatch or door is open.
3. Hot water leakage can burn and cause a cold-weather injury. Use caution if carrying activated heater in pocket.
4. After heating, the heater bag and MRE pouch will be very hot. Use caution when removing MRE pouch from bag.
5. Discard heater and bag after use. Do not drink the water remaining in the bag or use it in food items.

HEATER AND ITS BYPRODUCTS ARE NOT INTENDED FOR HUMAN CONSUMPTION

Do not throw unactivated heaters in trash.

Recycle or dispose unactivated heaters in accordance with environmental regulations.

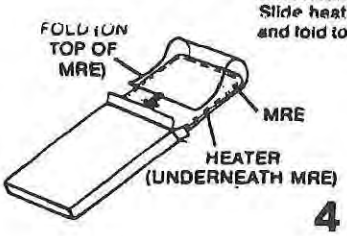
TEAR HERE TO REMOVE MRE



1 Remove MRE pouch from carton and save carton.

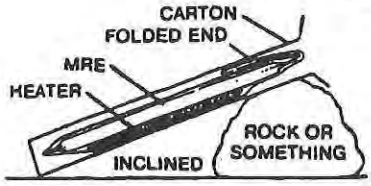
2 Tear off top of bag. Place MRE pouch in bag with heater.

3 While holding MRE pouch and heater above lines on bag, pour water into bag until it reaches a level between lines. Slide heater and MRE to bottom of bag, and fold top of bag to side opposite heater.



4 Stuff assembly into carton with top of bag folded over top of MRE and heater underneath.

5 With heater UNDERNEATH MRE, hold carton level until heater feels warm or until one minute elapses.



6 To prevent water from escaping and to maximize heat output, always keep:
- HEATER located UNDERNEATH MRE;
- BAG folded OVER TOP of MRE; and
- CARTON INCLINED, with FOLDED END of bag UP.

After ten to fifteen minutes (depending on air temperature) top half of bag can be torn off and the MRE can be removed and eaten.

Knead MRE to ensure uniform temperature. CAUTION: The contents will be HOT.

DO NOT OVERFILL

Appendix F
Instructions for the TDA

TEAR HERE TO OPEN BAG

MRE (MEAL, READY-TO-EAT) HEATER

USA NRDEC 98-P

WARNINGS

HEATER AND ITS BYPRODUCTS ARE NOT INTENDED FOR HUMAN CONSUMPTION

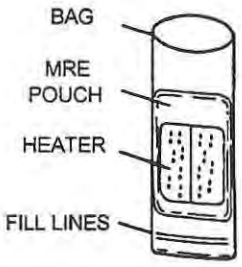
1. Heater becomes HOT during use. Keep heater away from skin. When handling heater, keep heater materials and hands away from eyes.
2. After heating, the heater bag and MRE pouch will be very hot. Use caution when removing MRE pouch from bag.
3. Discard heater and bag after use. Do not drink any water remaining in the bag or use it in food items.

SPECIAL INSTRUCTIONS FOR FROZEN MRE:

- Use two heaters: one to thaw, one to heat.
- To thaw frozen MRE: Follow instructions below except, add water to bag before adding MRE. When heater begins to feel warm, add MRE to bag.
- To heat thawed MRE: Follow instructions below.
- In cold weather, heater can be placed in BDU pocket to heat MRE. Make sure folded end of bag is up to prevent water from leaking out.

OPERATING INSTRUCTIONS

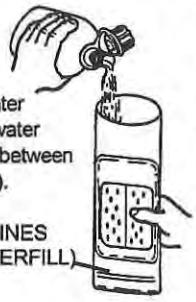
1 Remove MRE pouch from carton and save carton for use in step 4.

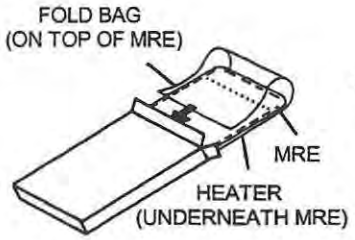


2 Tear off top of bag. Place MRE pouch along side heater in heater bag.

TEAR HERE TO REMOVE MRE

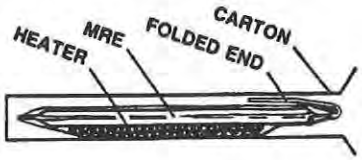
3 Raise MRE pouch and heater above lines on bag. Pour water into bag until water level is between Fill Lines (Do NOT Overfill).





4 Slide heater and MRE to bottom of bag. Fold top of bag to side opposite heater. Stuff assembly into carton with top of bag folded over top of MRE and heater on bottom, underneath MRE.

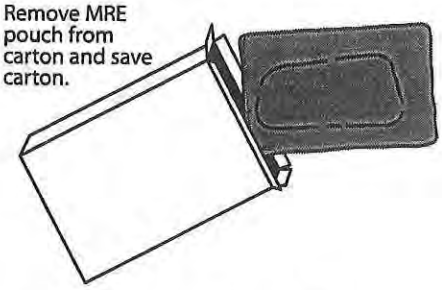
5 For best results keep heater UNDERNEATH MRE and place carton on ground or flat surface. If carrying activated heater inside pocket, keep folded end of bag up.



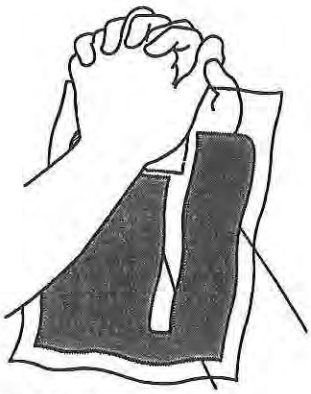
6 After ten to fifteen minutes (depending on air temperature) top half of bag can be torn off and the MRE can be removed from bag and eaten. Knead MRE to ensure uniform temperature. CAUTION: Contents will be HOT.

Appendix G
Instructions for the Tempra

1. Remove MRE pouch from carton and save carton.

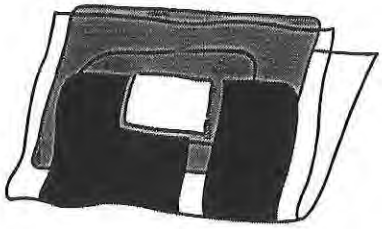


2. Hold MRE heater and pop activator bubble with heels of hands



3. Quickly disperse activating solution by vigorously shaking/wringing heater for 30-60 seconds (heater will become too hot to handle after 1 minute). Shake until all heater material turns a dark color.

4. Wrap heater around MRE pouch



5. Slide heater and pouch into carton. Wait 15 minutes for MRE to heat.

CAUTION: Heater will be HOT; Remove carefully.